Claims

1. A tuneable grating assisted directional optical coupler (10) to couple a transmission signal, comprising

- a first waveguide (1) including a first core (7) and a first cladding (4), said first waveguide having a first effective refractive index (n_1),
- a second waveguide (2) including a second core (8) and a second cladding (3), said second waveguide having a second effective refractive index (n_2), different from said first effective index (n_1), and being in substantially close proximity to said first waveguide (1) in a predetermined region (L) to provide coupling there between,
- a periodic perturbation (12) positioned in said coupling region (L) for causing said coupling to be wavelength selective for one given wavelength (λ_0) function of said first (n_1) and/or said second (n_2) effective refractive index,
- in which said second cladding (3) of said second waveguide (2) comprises a tuneable material and said first cladding (4) of said first waveguide (1) comprise a non-tuneable material.

2. Coupler (10) according to claim 1, wherein said tuneable material has a refractive index (n_3; n_7) which can be varied upon variation of an external parameter.

3. Coupler (10) according to claim 2, wherein the tuneable material is variable with temperature (T) and said tuneable material has a ratio $|\frac{\Delta n}{n}|$ between the variation Δn of the refractive index (n_3; n_7) and the refractive index (n_3;n_7) of said tuneable material not smaller than 10^{-2} for a temperature variation not larger than 100°C.

4. Coupler (10) according to claim 2, wherein the tuneable material is variable with an electric field (E) and said tuneable material has a ratio $|\frac{\Delta n}{n}|$ between the variation Δn of the refractive index (n_3; n_7) and the refractive index (n_3;n_7) of said tuneable material not smaller than 10^{-2} for an electric field variation not larger than 1 V/μm.
5. Coupler (10) according to claim 2 or 3, wherein the refractive index (n_3;n_7) of said tuneable material is variable with temperature (T) and said tuneable material has a thermo-optic coefficient $\left|\frac{dn}{dT}\right|$ greater than or equal to 10^{-4}/°C.
6. Coupler (10) according to claims 2, 3 or 5, wherein said tuneable material variable with temperature (T) is a polymer.
7. Coupler (10) according to claims 2 or 4, wherein the refractive index (n_3;n_7) of said tuneable material is variable with electric field (E) and said tuneable material has a electro-optic coefficient ($|r|$) greater than or equal to 2.5 nm/V.
8. Coupler (10) according to any one of the preceding claims, wherein said first (1) and said second waveguide (2) are vertically stacked on a substrate (6).
9. Coupler (10) according to claim 7, wherein said first waveguide (1) is the lower waveguide, while said second waveguide (2) is the upper waveguide.
10. Coupler (10) according to any one of the preceding claims, wherein said first (7) and/or said second core (8) comprise/comprises silicon compound materials/material.

11. Coupler (10) according to any one of the preceding claims, wherein said first cladding (4) of said first waveguide (1) comprises silica glass.

12. Coupler (10) according to any one of the preceding claims, wherein said given wavelength (λ_0) is in the range of 1530-1565 nm.

13. Coupler (10) according to any one of the preceding claims, wherein said transmission signal carries a given number of optical channels having wavelengths (λ_1,....., λ_n) comprised between about 1530 and about 1565 nm.

14. Coupler (10) according to any one of the preceding claims, wherein said periodic perturbation (12) is a Bragg grating having a grating period (Λ) and said given wavelength (λ_0) is given by $\lambda_0 = \Lambda(n_1 \pm n_2)$.

15. Coupler (10) according to any one of the preceding claims, wherein said transmission signal is supplied to said first waveguide (1), and a coupled signal of given wavelength (λ_0) is outputted by said second waveguide (2).

16. Coupler (10) according to any one of the preceding claims, wherein said periodic perturbation (12) is realised on the first waveguide (1).

17. Coupler (10) according to claim 16, wherein said periodic perturbation (12) is realised on said first core (7) of said first waveguide (1).

18. Coupler (10) according to any of claims 14 to 17, wherein said transmission signal and said coupled signal are contra-propagating and said given wavelength (λ_0) is given by $\lambda_0 = \Lambda(n_1 + n_2)$.

19. Coupler (10) according to any of claims 14 to 17, wherein said transmission signal and said coupled signal are co-propagating and said given wavelength (λ_0) is given by $\lambda_0 = \Lambda(n_1 - n_2)$.

20. Coupler (10) according to claim 18, wherein said first and said second effective indices (n_1, n_2) satisfy the following equation: $n_2 - n_1 > 2n_1\left(\frac{\lambda_{max}}{\lambda_{min}} - 1\right)$.

21. An add/drop optical device (100) comprising one of more of the tuneable grating assisted directional optical coupler (10) according to one or more of the claims 1-20.